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(54) **MOTORIZED BED**

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See application file for complete search history.

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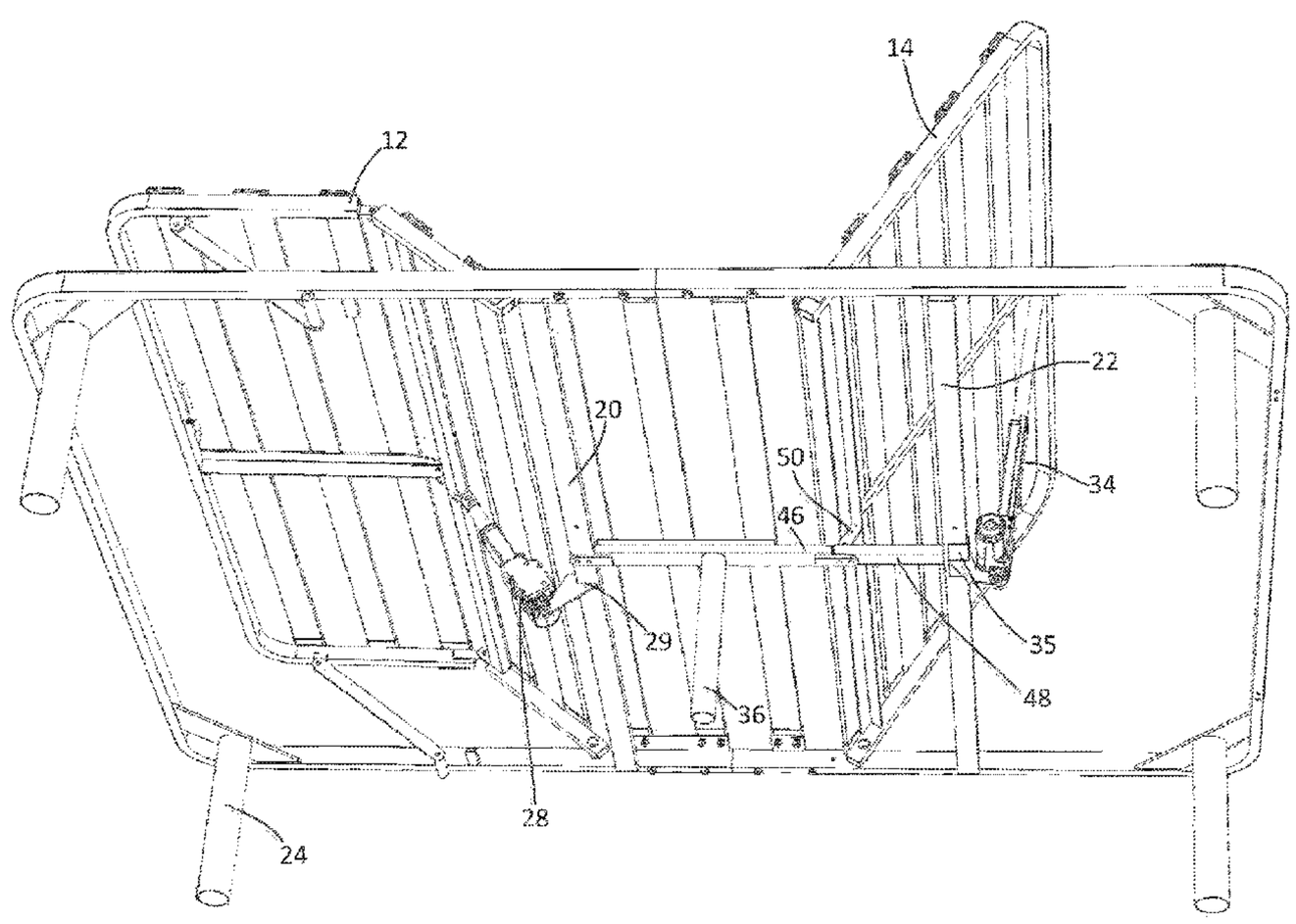
(57) **ABSTRACT**

A motorized bed includes a bed frame, a foot rest, a footrest actuator, a backrest, a backrest actuator, and a linkage part. The bed frame includes a first cross bar and a second cross bar. The footrest is rotatably mounted to the bed frame. The footrest actuator is mounted between the footrest and the first cross bar and configured to drive the footrest to rotate relative to the bed frame. The backrest is rotatably mounted to the bed frame. The backrest actuator is mounted between the backrest and the second cross bar and configured to drive the backrest to rotate relative to the bed frame. The linkage part is fixedly connected between the first cross bar and the second cross bar such that a force introduced by either of the footrest motor and the backrest motor is supported by both of the first cross bar and the second cross bar.

12 Claims, 4 Drawing Sheets



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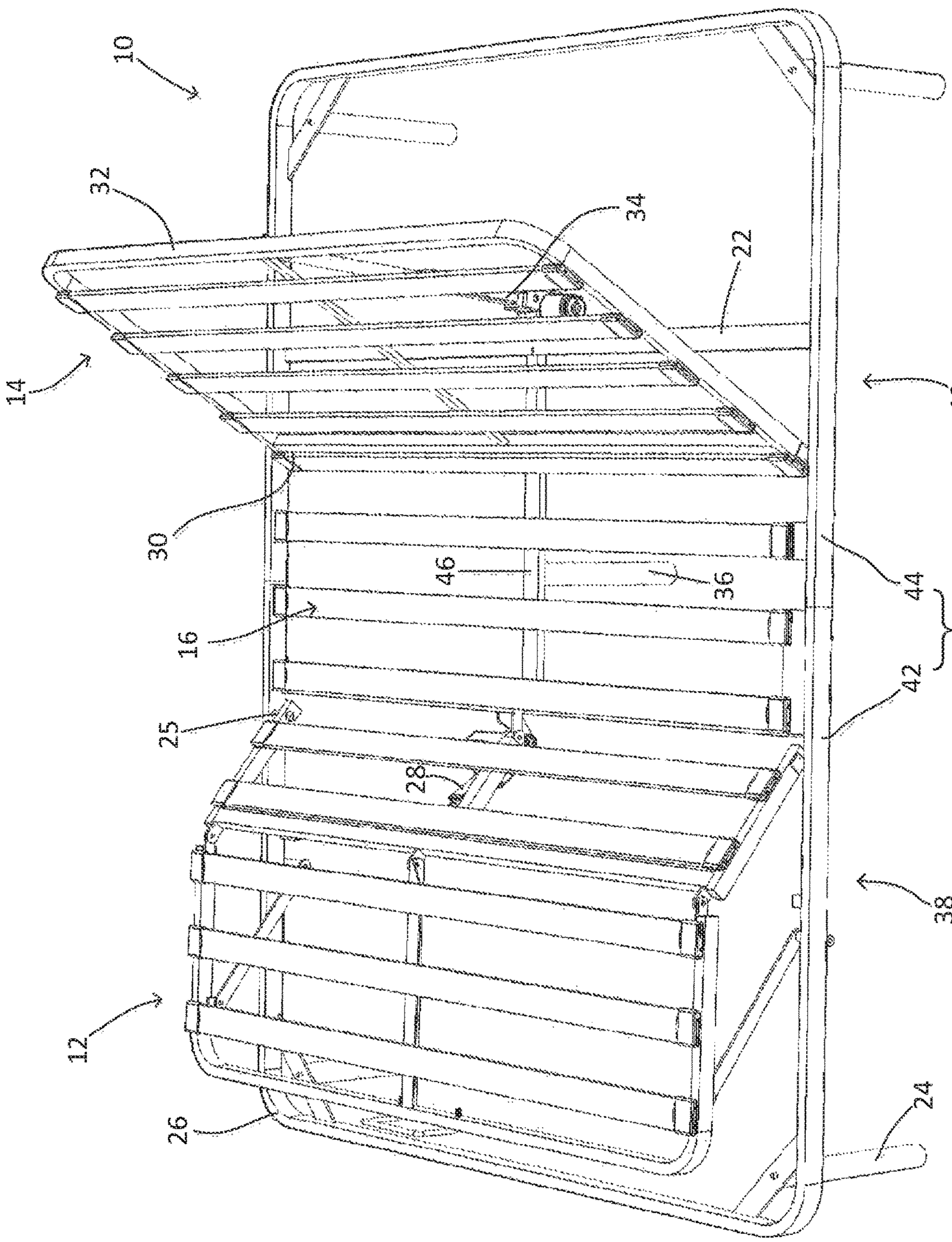

FIG. 1

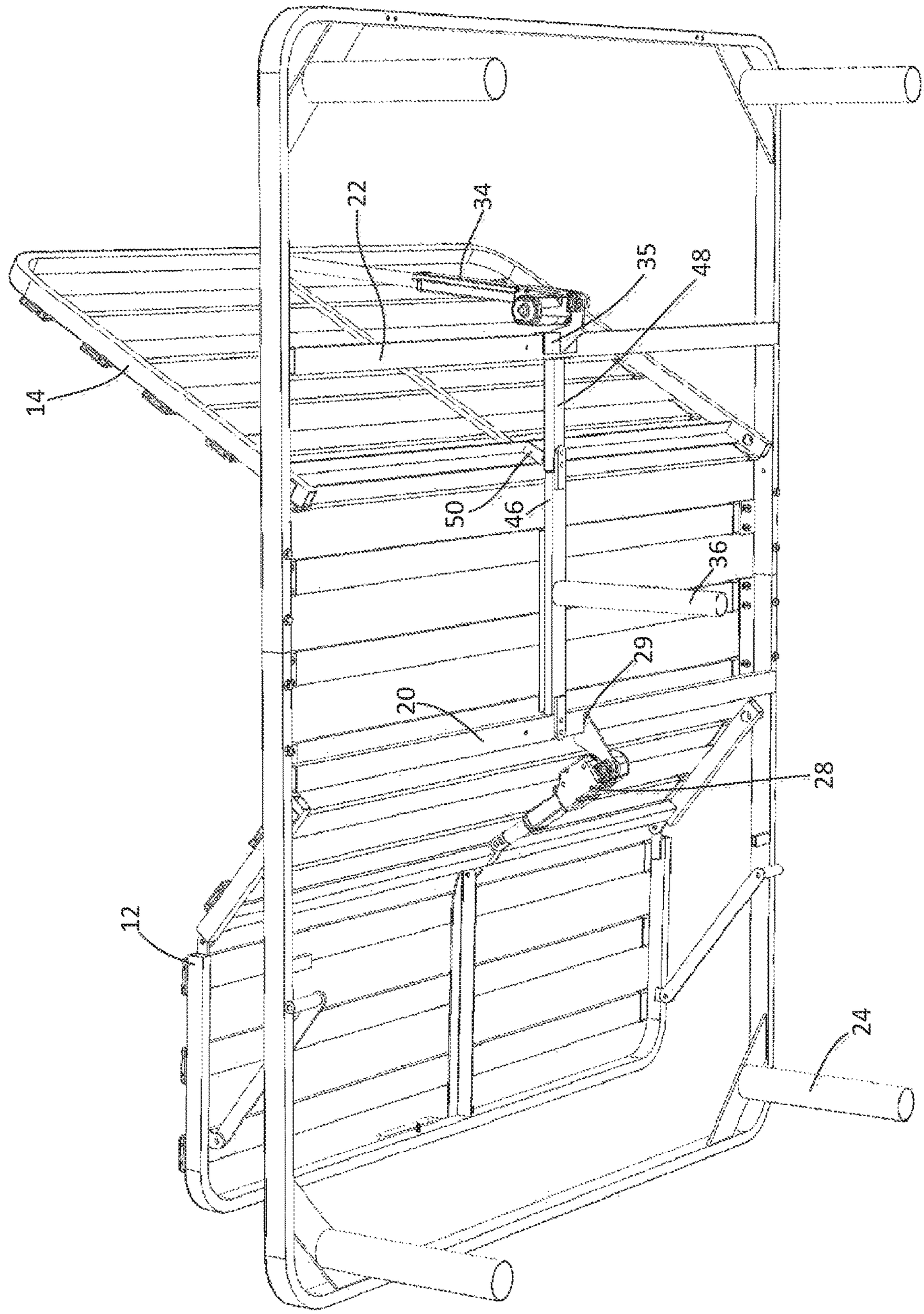

FIG. 2

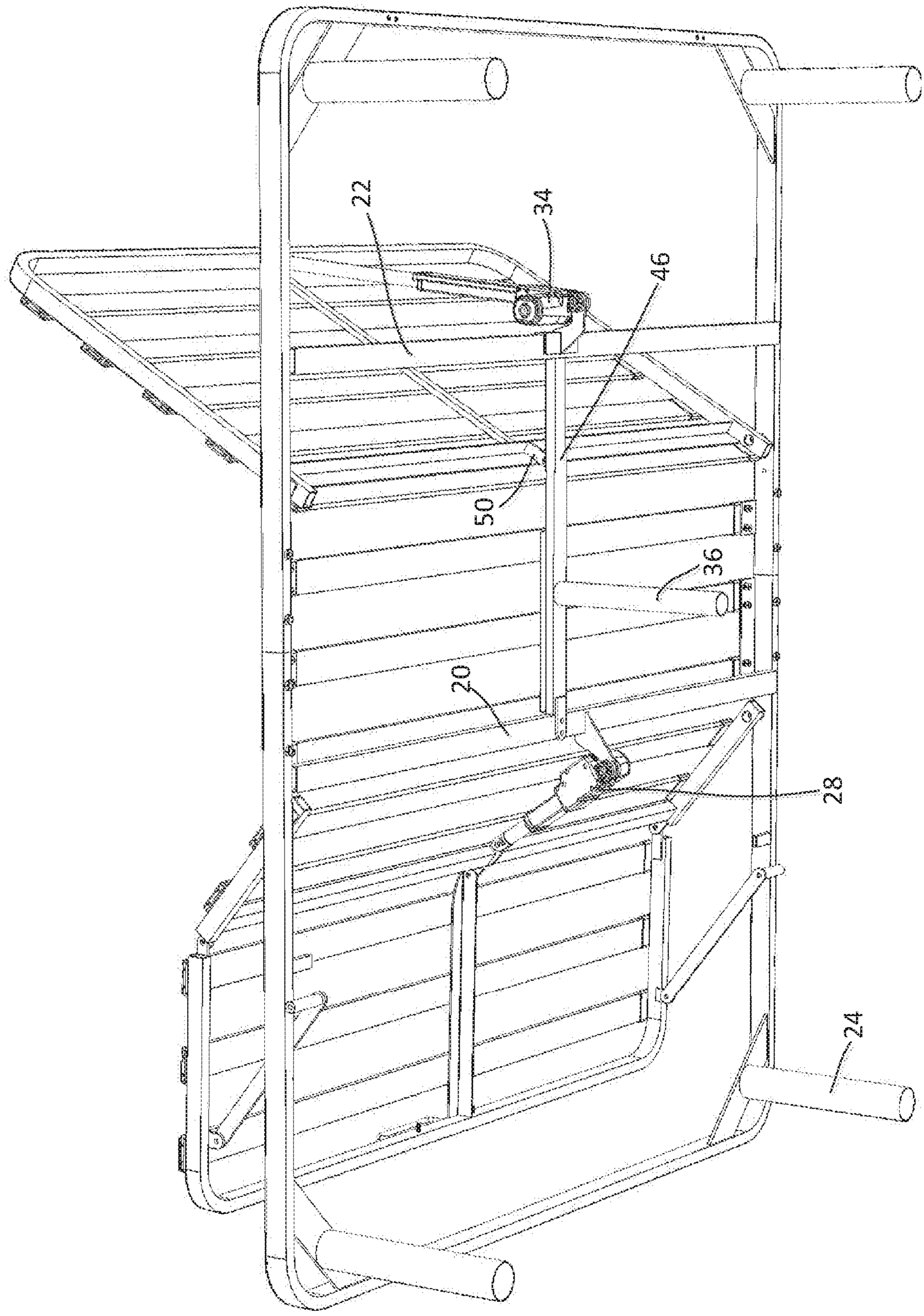

FIG. 3

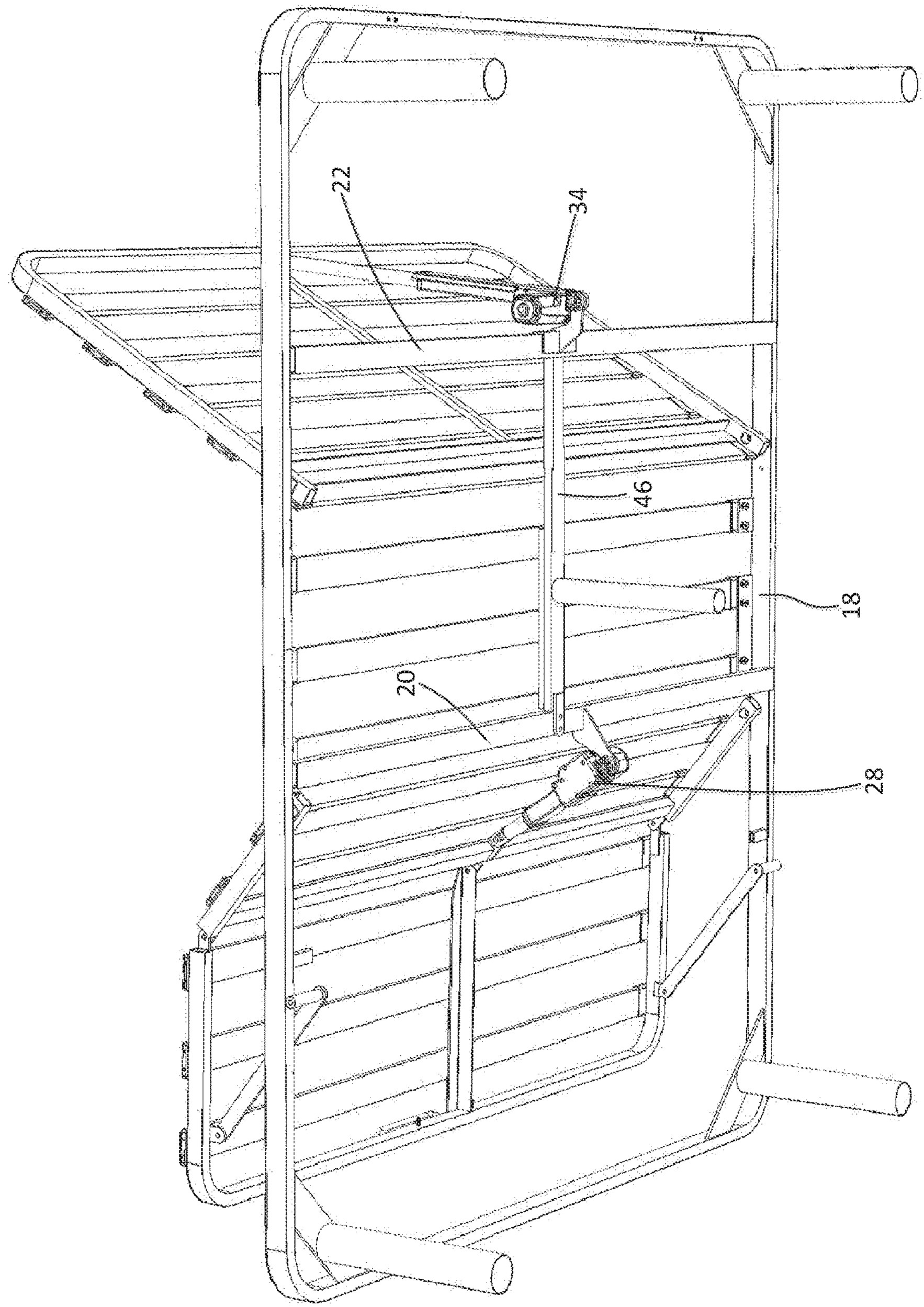

FIG. 4

MOTORIZED BED

FIELD

The present invention relates to a motorized mechanism and, in particular, to a motorized bed with low cost.

BACKGROUND

A motorized leisure bed usually includes a platform supported by a bed frame. The platform has a footrest and a backrest to be driven to lift or rotate by their respective actuators. Price is an important factor to consider when buying a leisure bed, especially in the entry level market. One approach of reducing cost is to reduce material cost by reducing the wall thickness of tubes used in the bed frame.

Using tubes with thinner walls has consequences, mainly in two areas. First, the supporting bed frame is not strong enough to support the payload (mattress and user) if supported by legs in the four corners, only. Therefore, typically additional legs are required in the middle of the bed, in addition to the legs at the corners of the bed. Conventionally, the additional legs are arranged on the middle of the outsides of the bed, which results in a poor appearance of the bed and may hinder the leg of a user beside the bed. Second, if the wall thickness of cross tubes in the bed supporting the actuators to operate the backrest and footrest is reduced to drive down cost further, these tubes may not be able to resist the forces applied by the actuators and bend.

What is needed, therefore, is a low cost bed with improved structural strength.

SUMMARY

Accordingly, the present invention is directed to a motorized bed with improved structural strength.

In one aspect, a motorized bed is provided which includes a bed frame, a foot rest, a footrest actuator, a backrest, a backrest actuator, and a linkage part. The bed frame includes a first cross bar and a second cross bar. The footrest is rotatably mounted to the bed frame. The footrest actuator is mounted between the footrest and the first cross bar and configured to drive the footrest to rotate relative to the bed frame. The backrest is rotatably mounted to the bed frame. The backrest actuator is mounted between the backrest and the second cross bar and configured to drive the backrest to rotate relative to the bed frame. The linkage part is fixedly connected between the first cross bar and the second cross bar such that a force introduced by either of the footrest motor and the backrest motor is supported by both of the first cross bar and the second cross bar.

In one embodiment, the linkage part is located at a middle area of the motorized bed.

In one embodiment, the footrest actuator and the backrest actuator are offset from each other in a length direction of the motorized bed.

In one embodiment, the footrest actuator connects to the first cross bar at a first fixation point, the backrest actuator connects to the second cross bar at a second fixation point, and the linkage part is in line with one of the first fixation point and the second fixation point while being offset from the other of the first fixation point and the second fixation point.

In one embodiment, the linkage part is in line with the second fixation point while being offset from the first fixation point.

In one embodiment, the footrest actuator connects to the first cross bar at a first fixation point, the backrest actuator connects to the second cross bar at a second fixation point, the linkage part connects to the first cross bar at a connection point close to the first fixation point and connects to the second cross bar at a connection point close to the second fixation point.

In one embodiment, the motorized bed further comprises a fixed section between the footrest and the backrest, the fixed section is fixedly mounted on the bed frame, and the linkage part is located beneath the fixed section.

In one embodiment, each of the first and second cross bars and the linkage part is tubular.

In one embodiment, the backrest comprises a mounting end rotatably mounted to the bed frame and a free end opposite to the mounting end, the second cross bar comprises an extension extending from a substantially middle portion thereof toward the first cross bar, a supporting piece fixedly connected with a substantially middle portion of the mounting end of the backrest is rotatably connected with the extension, and the linkage part is fixedly connected with the extension.

In one embodiment, the linkage part and the extension are both tubular and are end-to-end connected to each other.

In one embodiment, the linkage part reaches from the first cross bar directly to the second cross bar.

In one embodiment, the backrest comprises a mounting end rotatably mounted to the bed frame and a head end opposite to the mounting end, and a supporting piece fixedly connected with a substantially middle portion of the mounting end of the backrest is rotatably connected with the linkage part.

In another aspect, a motorized bed is provided which includes a foot half, and a head half fixedly connected to the foot half, and a linkage part. The foot half includes a first bed frame section with a first cross bar, a footrest rotatably mounted to the first bed frame section, and a footrest actuator mounted to the first cross bar and configured to drive the footrest to rotate relative to the first bed frame section. The head half includes a second bed frame section with a second cross bar, a backrest rotatably mounted to the second bed frame section, and a backrest actuator mounted to the second cross bar and configured to drive the backrest to rotate relative to the second bed frame section. The first bed frame section coupled to the second bed frame section. The linkage part is fixedly connected between the first cross bar and the second cross bar.

In one embodiment, the linkage part is located at a middle area of the motorized bed.

In one embodiment, the footrest actuator and the backrest actuator are offset from each other in a length direction of the motorized bed.

In one embodiment, the footrest actuator connects to the first cross bar at a first fixation point, the backrest actuator connects to the second cross bar at a second fixation point, and the linkage part is in line with one of the first fixation point and the second fixation point while being offset from the other of the first fixation point and the second fixation point.

In one embodiment, the linkage part is in line with the second fixation point while being offset from the first fixation point.

In one embodiment, the footrest actuator connects to the first cross bar at a first fixation point, the backrest actuator connects to the second cross bar at a second fixation point, the linkage part connects to the first cross bar at a connection

point close to the first fixation point and connects to the second cross bar at a connection point close to the second fixation point.

In still another aspect, a motorized bed is provided which includes a bed frame, a footrest, a footrest actuator, a backrest, a backrest actuator, and a linkage part. The bed frame includes a substantially rectangular frame body, a first cross bar and a second cross bar connected to the frame body, and supporting legs arranged at corners of the frame body. A footrest is rotatably mounted to the frame body. The footrest actuator is mounted to the first cross bar and configured to drive the footrest to rotate relative to the bed frame. The backrest rotatably mounted to the bed frame. The backrest actuator is mounted to the second cross bar and configured to drive the backrest to rotate relative to the bed frame. The linkage part has one end fixedly connected to the first cross bar and the other end fixedly connected to the second cross bar, the linkage part located at a substantially middle area of the motorized bed. An additional leg is connected to the linkage part to support the substantially middle area of the motorized bed.

In one embodiment, the footrest actuator and the backrest actuator are offset from each other in a length direction of the motorized bed. The footrest actuator connects to the first cross bar at a first fixation point, the backrest actuator connects to the second cross bar at a second fixation point, and the linkage part is in line with one of the first fixation point and the second fixation point while being offset from the other of the first fixation point and the second fixation point.

Other independent aspects of the invention will become apparent by consideration of the detailed description, claims and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top, perspective view of a motorized bed according to one embodiment of the present invention.

FIG. **2** is a bottom, perspective view of the motorized bed of FIG. **1**.

FIG. **3** is a bottom, perspective view of a motorized bed according to another embodiment of the present invention.

FIG. **4** is a bottom, perspective view of a motorized bed according to still another embodiment of the present invention.

DESCRIPTION OF THE EMBODIMENTS

Before any independent embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other independent embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. Use of "including" and "comprising" and variations thereof as used herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Use of "consisting of" and variations thereof as used herein is meant to encompass only the items listed thereafter and equivalents thereof. Further, it is to be understood that such terms as "forward", "rearward", "left", "right", "upward" and "downward", etc., are words of convenience and are not to be construed as limiting terms.

FIG. **1** is a top, perspective view of a motorized bed according to one embodiment of the present invention. The motorized bed generally includes a bed frame **10**, a footrest **12** and a backrest **14** rotatably mounted to the bed frame **10**, and a fixed section **16** fixed on the bed frame **10** and located between the footrest **12** and the backrest **14**. The footrest **12**, the backrest **14** and the fixed section **16** collectively form a platform supported on the bed frame **10**. In use, a mattress (not shown) is generally placed on the platform and is caused to deform upon lifting or rotating of the footrest **12** and the backrest **14**. Operation of such motorized bed is known in the art and, therefore, is not described herein in further detail.

The bed frame **10** includes a frame body **18**, a first cross bar **20** and a second cross bar **22** fixedly connected to the frame body **18**, and supporting legs **24** arranged at corners of the frame body **18**. In the illustrated embodiment, the frame body **18** is substantially rectangular in shape. The frame body **18** has a pair of opposite long bars and a pair of opposite short bars. The first cross bar **20** is bridged between the long bars near a foot end of the bed, and the second cross bar **22** is bridged between the long bars near a head end of the bed. The long bars and short bars of the frame body **18**, and the first and second cross bars **20**, **22** can be all tubular.

The footrest **12** has a mounting end **25** and an opposite free end **26**. Opposite sides of the mounting end **25** of the footrest **12** are rotatably mounted to the long bars of the frame body **18**, respectively, which allows for rotation of the footrest **12** relative to the bed frame **10**. A footrest actuator **28** is mounted to the first cross bar **20** and configured to drive the footrest **28** to rotate relative to the bed frame **10**. The footrest actuator **28** connects to the first cross bar **20** at a first fixation point **29** that is located at a substantially middle portion of the first cross bar **20**.

The backrest **14** has a mounting end **30** and an opposite free end **32**. Opposite sides of the mounting end **30** of the backrest **14** are rotatably mounted to the long bars of the frame body **18**, respectively, which allows rotation of the backrest **14** relative to the bed frame **10**. A backrest actuator **34** is mounted to the second cross bar **22** and configured to drive the backrest **14** to rotate relative to the bed frame **10**. The backrest actuator **34** connects to the second cross bar **22** at a second fixation point **35** that is located at a substantially middle portion of the second cross bar **22**.

In the illustrated embodiment, four supporting legs **36** are arranged at four corners of the frame body **18** to support the bed. The supporting legs **36** depend from the frame body **18** or a connecting piece fixed to the frame body **18**. In another embodiment, supporting legs may also be arranged at other locations along the frame body **18**.

In the illustrated embodiment, for packaging reasons, the motorized bed is split in half, including a foot half **38** and a head half **40** fixedly connected to each other. This allows for compact packaging of the motorized bed, thus facilitating transportation of the motorized bed. In particular, the foot half **38** includes a generally U-shaped first bed frame section **42**, the head half **40** includes a generally U-shaped second bed section **44**, and the first bed frame section **42** and the second bed frame section **44** are coupled to form the substantially rectangular frame body **18**. The first cross bar **20** is connected to the first bed frame section **42**, and the second cross tube **22** is connected to the second bed frame section **44**. Two supporting legs **36** are connected to the first bed frame section **42**, and the other two legs **36** are connected to the second bed frame section **44**.

When packaged for transportation, the foot half **38** and the head half **40** are separated and stacked in a packaging box with bottom sides of the foot half **38** and the head half **40** facing toward each other.

If the motorized bed is split in half, the footrest actuator **28** and the backrest actuator **34** are preferably offset from each other in a length direction of the motorized bed. In particular, the first fixation point **29** of the footrest actuator **28** on the first cross bar **20** is offset from the second fixation point **35** of the backrest actuator **34** on the second cross bar **22**. Because of the offset design, the footrest actuator **29** on the foot half **38** and the backrest actuator **34** on the head half **40** do not interference with each other when the foot half **38** and the head half **40** are stacked in the packaging box, thus reducing the overall thickness of the package. It should be understood that the footrest actuator **28** and the backrest actuator **34** may also be aligned with each other in the length direction of the motorized bed.

A linkage part **46** is fixedly connected between the first cross bar **20** and the second cross bar **22** and located beneath the fixed section **16**. Preferably, the linkage part **46** is located at a substantially middle area of the motorized bed and in line with one of the first fixation point **29** and the second fixation point **35** while being offset from the other of the first fixation point **29** and the second fixation point **35**. In the illustrated embodiment, the linkage part **46** is in line with the second fixation point **35** while being offset from the first fixation point **29**. In an alternative embodiment not illustrated, the linkage part **46** connects to the first cross bar **20** at a connection point close to the first fixation point **29** and connects to the second cross bar **22** at a connection point close to the second fixation point **35**.

In the embodiment illustrated in FIG. **1** and FIG. **2**, the second cross bar **22** includes an extension **48** extending from a substantially middle portion thereof toward the first cross bar **20**. A supporting piece **50** fixedly connected with a substantially middle portion of the mounting end **30** of the backrest **14** is rotatably connected with the extension **48**. This provides an extra joint in the middle of the backrest **14** to increase the support strength of the backrest **14**, which is especially advantageous for wide backrest **14**. In this embodiment, the extension **48** is welded on the second cross bar **22** and may also be tubular. The linkage part **46** has one end fixedly connected to the first cross bar **20** and the other end fixedly connected to the extension **48**. The linkage part **46** can be tubular and can be end-to-end connected to the extension **48**.

In the embodiment of FIG. **1** and FIG. **2**, the function of the extension **48** is to provide an extra joint in the middle of the backrest **14**, and the extension **48** is welded on the second cross bar **22**. Therefore, the extension **48** becomes an integral part of the second cross bar **22**. In some embodiments, for example the embodiment of FIG. **1** and FIG. **2**, it may be sufficient to put the linkage part **46** between the first cross bar **20** and the extension **48**, in which case the linkage part **46** is indirectly connected to the second cross bar **22** through the extension **48**. It should be understood that the linkage part **46** can also reach from the first cross bar **20** directly to the second cross bar **22**, such as in the embodiment of FIG. **3** discussed below. It should also be understood that the linkage part **46** can still reach from the first cross bar **20** directly to the second cross bar **22** even if the extension is provided. In this case, the linkage part **46** is not connected to the extension **46** but rather directly connected to the second cross bar **22**.

In another embodiment illustrated in FIG. **3**, the linkage part **46** reaches from the first cross bar **20** directly to the second cross bar **22**. That is, one end of the linkage part **46** is fixedly connected with the first cross bar **20**, and the other end is fixedly connected with the second cross bar **22**. The supporting piece **50** fixedly connected with the substantially middle portion of the mounting end **30** of the backrest **14** is rotatably connected with the linkage part **46**. Likewise, this provides an extra joint in the middle of the backrest **14** to increase the support strength of the backrest **14**. In this embodiment, one end of the linkage part **46** is fixedly connected to the first cross bar **20**, and the other end is fixedly connected to the second cross bar **22**.

While the motorized bed is illustrated as providing an extra joint in the middle of the backrest in the above embodiments, it should be understood that a motorized bed in accordance with an alternative embodiment of the present invention can have no such extra joint. For example, for a bed with small width or having a backrest itself capable of providing sufficient support, the extra joint is not needed.

FIG. **4** illustrates another embodiment of the motorized bed. In this embodiment, the long side of the frame body **18** is an integral piece. That is, the motorized bed is not split into the foot half and head half during transportation. In addition, the linkage part **46** reaches from the first cross bar **20** to the second cross bar **22**. That is, one end of the linkage bar **46** is fixedly connected with the first cross bar **20**, and the other end is fixedly connected with the second cross bar **22**. Different from the above embodiments, no extension is formed on the second cross bar **22** and, therefore, no extra joint is provided in the middle of the backrest of the motorized bed of this embodiment.

With the provision of the additional linkage part **46**, a force introduced by either of the footrest actuator **28** and the backrest actuator **34** is supported by both of the first cross bar **28** and the second cross bar **34**. Also, the forces introduced by the two actuators **28**, **34** on their respective cross bars **20**, **22** are in opposite directions and they mainly neutralize each other through the linkage part **46**. The provision of the linkage part **46** can increase the structural strength of the bed frame. Therefore, even the wall thickness of the cross bars is reduced in order to reduce cost, the bed frame can still provide acceptable support strength.

If the linkage part **46** and the actuators are placed in or close to the middle of the motorized bed, the linkage part **46** allows an additional supporting leg **52** to be placed in the middle to support a middle portion of the bed. Therefore, even if the additional supporting leg is desired, it can be placed in the interior of the bed, which looks nicer and is cheaper compared to the additional leg added to the middle of each outside of the conventional bed.

While the linkage part **46** is illustrated as being in or close to the middle of the motorized bed in the embodiments above, it should be understood that other locations of the linkage part **46** are possible as long as it can provide enhanced support strength. Therefore, the locations of the linkage part **46** described herein are illustrative rather than restrictive. In addition, while only one linkage part **46** is illustrated in the embodiments above, it should be understood that there may be more than one linkage part connected between the first and second cross bars.

Although the invention is described with reference to one or more embodiments, it will be apparent to those skilled in the art that various modifications and variations can be made to the disclosed structure without departing from the scope or spirit of the invention. In view of the foregoing, it is intended that the present invention cover modifications and variations of this invention provided they fall within the scope of the following claims and their equivalents.

What is claimed is:

1. A motorized bed comprising:

a bed frame comprising a first cross bar and a second cross bar;

a footrest rotatably mounted to the bed frame, the footrest comprising a mounting end rotatably mounted to the bed frame and an opposite tree end, the free end of the footrest located closer to the first cross bar than the second cross bar;

a footrest actuator mounted between the footrest and the first cross bar and configured to drive the footrest to rotate relative to the bed frame;

a backrest rotatably mounted to the bed frame, the backrest comprising a mounting end rotatably mounted to the bed frame and an opposite lice end, the free end of the backrest located closer to the second cross bar than the first cross bar;

a backrest actuator mounted between the backrest and the second cross bar and configured to drive the backrest to rotate relative to the bed frame; and

a linkage part fixedly connected between a middle of the first cross bar and the second cross bar such that one of the backrest actuator and the footrest actuator is substantially in line with the linkage part in a way a force introduced by either of the footrest actuator and the backrest actuator is supported by both of the first cross bar and the second cross bar,

wherein the second cross bar comprises an extension extending from a substantially middle portion thereof toward the first cross bar, a supporting piece fixedly connected with a substantially middle portion of the mounting end of the backrest is rotatably connected with the extension, and the linkage part is fixedly connected with the extension.

2. The motorized bed of claim **1**, wherein the linkage part is located at a middle area of the motorized bed in a transverse direction of the motorized bed.

3. The motorized bed of claim **1**, wherein the footrest actuator and the backrest actuator are offset from each other in a length direction of the motorized bed.

4. The motorized bed of claim **3**, wherein the footrest actuator connects to the first cross bar at a first fixation point, the backrest actuator connects to the second cross bar at a second fixation point, and the linkage part is in line with one of the first fixation point and the second fixation point while being offset from the other of the first fixation point and the second fixation point.

5. The motorized bed of claim **4**, wherein the linkage part is in line with the second fixation point while being offset from the first fixation point.

6. The motorized bed of claim **3**, wherein the footrest actuator connects to the first cross bar at a first fixation point, the backrest actuator connects to the second cross bar at a second fixation point, the linkage part connects to the first cross bar at a connection point close to the first fixation point and connects to the second cross bar at a connection point close to the second fixation point.

7. The motorized bed of claim **1**, wherein the motorized bed further comprises a fixed section between the footrest and the backrest, the fixed section is fixedly mounted on the bed frame, and the linkage part is located beneath the fixed section.

8. The motorized bed of claim **1**, wherein each of the first and second cross bars and the linkage part is tubular.

9. The motorized bed of claim **1**, wherein the linkage part and the extension are both tubular and are end-to-end connected to each other.

10. A motorized bed comprising:

a bed frame comprising a first cross bar and a second cross bar;

a footrest rotatably mounted to the bed frame, the footrest comprising a mounting end rotatably mounted to the bed frame and an opposite free end, the free end of the footrest located closer to the first cross bar than the second cross bar;

a footrest actuator mounted between the footrest and the first cross bar and configured to drive the footrest to rotate relative to the bed frame;

a backrest rotatably mounted to the bed frame, the backrest comprising a mounting end rotatably mounted to the bed frame and an opposite free end, the free end of the backrest located closer to the second cross bar than the first cross bar;

a backrest actuator mounted between the backrest and the second cross bar and configured to drive the backrest to rotate relative to the bed frame; and

a linkage part fixedly connected between a middle of the first cross bar and the second cross bar such that one of the backrest actuator and the footrest actuator is substantially in line with the linkage part in a way a force introduced by either of the footrest actuator and the backrest actuator is supported by both of the first cross bar and the second cross bar,

wherein the linkage part reaches from the first cross bar directly to the second cross bar; and

wherein a supporting piece fixedly connected with a substantially middle portion of the mounting end of the backrest is rotatably connected with the linkage part.

11. A motorized bed comprising:

a bed frame comprising a substantially rectangular frame body, a first cross bar and a second cross bar connected to the frame body, and supporting legs arranged at corners of the frame body;

a footrest rotatably mounted to the frame body, the footrest comprising a mounting end rotatably mounted to the bed frame and an opposite free end, the free end of the footrest located closer to the first cross bar than the second cross bar;

a footrest actuator mounted to the first cross bar and configured to drive the footrest to rotate relative to the bed frame;

a backrest rotatably mounted to the bed frame, the backrest comprising a mounting end rotatably mounted to the bed frame and an opposite free end, the free end of the backrest located closer to the second cross bar than the first cross bar;

a backrest actuator mounted to the second cross bar and configured to drive the backrest to rotate relative to the bed frame;

a linkage part having one end fixedly connected to the first cross bar and the other end fixedly connected to the second cross bar, the linkage part located at a substantially middle area of the motorized bed; and

an additional leg connected to the linkage part to support the substantially middle area of the motorized bed.

12. The motorized bed of claim **11**, wherein the footrest actuator and the backrest actuator are offset from each other in a length direction of the motorized bed, the footrest actuator connects to the first cross bar at a first fixation point, the backrest actuator connects to the second cross bar at a second fixation point, and the linkage part is in line with one

of the first fixation point and the second fixation point while being offset from the other of the first fixation point and the second fixation point.

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